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(54) **Continuous extrusion apparatus.**

(57) Apparatus for the continuous extrusion of metal cladding 36 on to a thermally sensitive, continuous core 38 in which feed 34 is introduced into a circumferential groove 4 in a rotating wheel 2 to contact arcuate tooling 6 and an abutment. The feed is constrained by the abutment to flow through an orifice 8 to an extrusion chamber 10 around a hollow, open ended, portal mandrel 12 to extrude through an annular orifice 22. A shroud 26 of high thermal insulation properties, such as a braided glass fibre sleeve, is interposed between the interior of the cladding 36 and the core 32 and is of a thickness and length sufficient to limit to an acceptable rate transfer from the extruded cladding 36 of heat generated by extrusion to the temperature sensitive core 32.

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"CONTINUOUS EXTRUSION APPARATUS."
DESCRIPTION.

This invention relates to apparatus for the forming of metals by a continuous extrusion process in which feedstock is introduced into a circumferential groove in a rotating wheel to pass into a passageway formed between the groove and arcuate tooling extending into the groove. The tooling includes an orifice in a die top extending in a generally radial direction from the groove to a die and an abutment is provided to constrain the feedstock to flow through the orifice and the die.

In EP-A-0125788 there is described continuous extrusion apparatus in which the orifice leads to a toroidal, extrusion chamber. A portal mandrel is positioned by means of a stub in the die top and extends horizontally and parallel to a line tangential to the wheel co-axially through the extrusion chamber and a die body wall to form an uninterrupted extrusion orifice discharging through the face of the die top.

The mandrel is of hollow, open-ended form positioned with a stepped rear end portion co-acting with correspondingly stepped bores in the die top. A stream of cooling air is supplied to the interior of the mandrel and directed into contact with the interior of the extruded product by a shroud extending internally and forwardly of the mandrel, the air exhausting internally of the shroud to the rear of the die top.

By the present invention there is provided continuous extrusion apparatus including a rotatable wheel formed with a circumferential groove, arcuate tooling having a portion bounding a radially outer portion of the groove to form a passageway, an abutment portion extending into the groove, and an orifice in a die top portion extending in a generally radial direction from the passageway to a toroidal extrusion chamber, the toroidal extrusion chamber discharging to a hollow portal mandrel positioned in the die top portion, and a tubular shroud extending internally and forwardly of the hollow portal mandrel, the apparatus being adpated to extrude a metallic cladding around a temperature sensitive core, in which the shroud is fabricated of a material having high thermal insulation properties and is formed with a

thickness and length sufficient to limit to an acceptable rate transfer from the extruded metallic cladding of heat generated by extrusion to the temperature sensitive core.

The use of such a shroud wholly or partly dispenses with the need to provide gas cooling to the inside of the product tube and thereby effects an economy in both capital and operating costs.

The invention will now be described, by way of example, with reference to the accompanying, partly diagrammatic, drawing showing a cross-sectional side elevation of a portion of a continuous extrusion apparatus.

As shown in the drawing, a rotatable wheel 2 formed with a circumferential groove 4 and arcuate tooling 6 bounding a radially outer portion of the groove is provided with an exit aperture 8 extending in a generally radial direction from the groove to a toroidal extrusion chamber 10. A hollow portal mandrel 12 is positioned by means of a first shoulder 14, in a die chamber portion 16 of the tooling to extend horizontally and parallel to a line tangential to the wheel co-axially through the extrusion chamber to form, in conjunction

with an annular cross-section die body 18 seated on a second shoulder 20 formed on the die chamber portion 16, an uninterrupted extrusion orifice 22 discharging through the face 24 of the die tooling 6.

The mandrel 12 is open ended and has a braided, flexible, glass fibre shroud 26 positioned therein by forming a rear end portion of the shroud with an outer enlargement 28 seating on a shoulder 30 provided at the entry at the rear of the mandrel.

In operation, a temperature sensitive core 32 which is to be clad, such as core having a plastics material as an outer layer, is fed, in the same direction as the direction of feed of cladding product feedstock 34, through the hollow mandrel 12 emerging at the extrusion orifice 22 to receive a cladding 36 of the extruded product.

The braided, glass fibre, shroud 26 is of sufficient length and thickness as to protect the core 32 from the heat emitted from the mandrel 12 and the cladding 36, which immediately after extrusion is at a temperature of about 450°C, by limiting the rate of heat transfer from the product to the core to acceptable rates.

A reducing roller or die system (not shown) is provided to effect reducing down of the extruded cladding 36 on to the core 32 beyond the forward portion 38 of the shroud 26 where the temperature of the cladding drops to an acceptable level through heat dissipation to the surrounding air or other cooling means.

Since the braided, glass fibre, shroud 26 is flexible the cladding 36 and the core 32 are free to deflect into a curve between the extrusion orifice 22 and take up means (not shown), thereby avoiding undue stress on the mandrel and the cladding.

In instances where, on start-up, it is desirable not to have the flexible shroud 26 in position until steady extrusion conditions have been established, the shroud is arranged to be slidably positionable within the mandrel and is fed into and through the hollow mandrel 12 once steady extrusion conditions are achieved until the enlargement 28 on the shroud seats on the shoulder 30 on the mandrel.

In an alternative arrangement, a shroud of material having high thermal insulating properties of a rigid form extends co-axially of the hollow mandrel. A rear end portion of the shroud is formed with an outer enlargement

seating on a shoulder at the entry at the rear of the mandrel and extends internally of the mandrel to project forwardly within the extruded tube a distance to enable sufficient cooling of the extended tube to occur before contact with heat sensitive core material fed through the shroud, the thickness of the shroud being sufficient thermally to protect the core material from the heat in the hollow mandrel and in the tube immediately following extrusion. The heat may be dissipated to the surrounding air by natural or forced convection. Further heat dissipation may be achieved by channelling a flow of coolant, such as air or nitrogen along the exterior or interior of the shroud to exhaust internally or externally of the shroud.

CLAIMS

1. A continuous extrusion apparatus including a rotatable wheel (2) formed with a circumferential groove (4), arcuate tooling having a portion bounding a radially outer portion of the groove to form a passageway (8), an abutment portion extending into the groove, and an orifice (10) in a die top portion extending in a generally radial direction from the passageway to a toroidal extrusion chamber (22), the toroidal extrusion chamber discharging to a hollow portal mandrel (12) positioned in the die top portion, and a tubular shroud (26) extending internally and forwardly of the hollow portal mandrel, the apparatus being adapted to extrude a metallic cladding (36) around a temperature sensitive core (32), characterised in that the shroud (26) is fabricated of a material having high thermal insulation properties and is formed with a thickness and length sufficient to limit to an acceptable rate transfer from the extruded metallic cladding (36) of heat generated by extrusion to the temperature sensitive core (32).

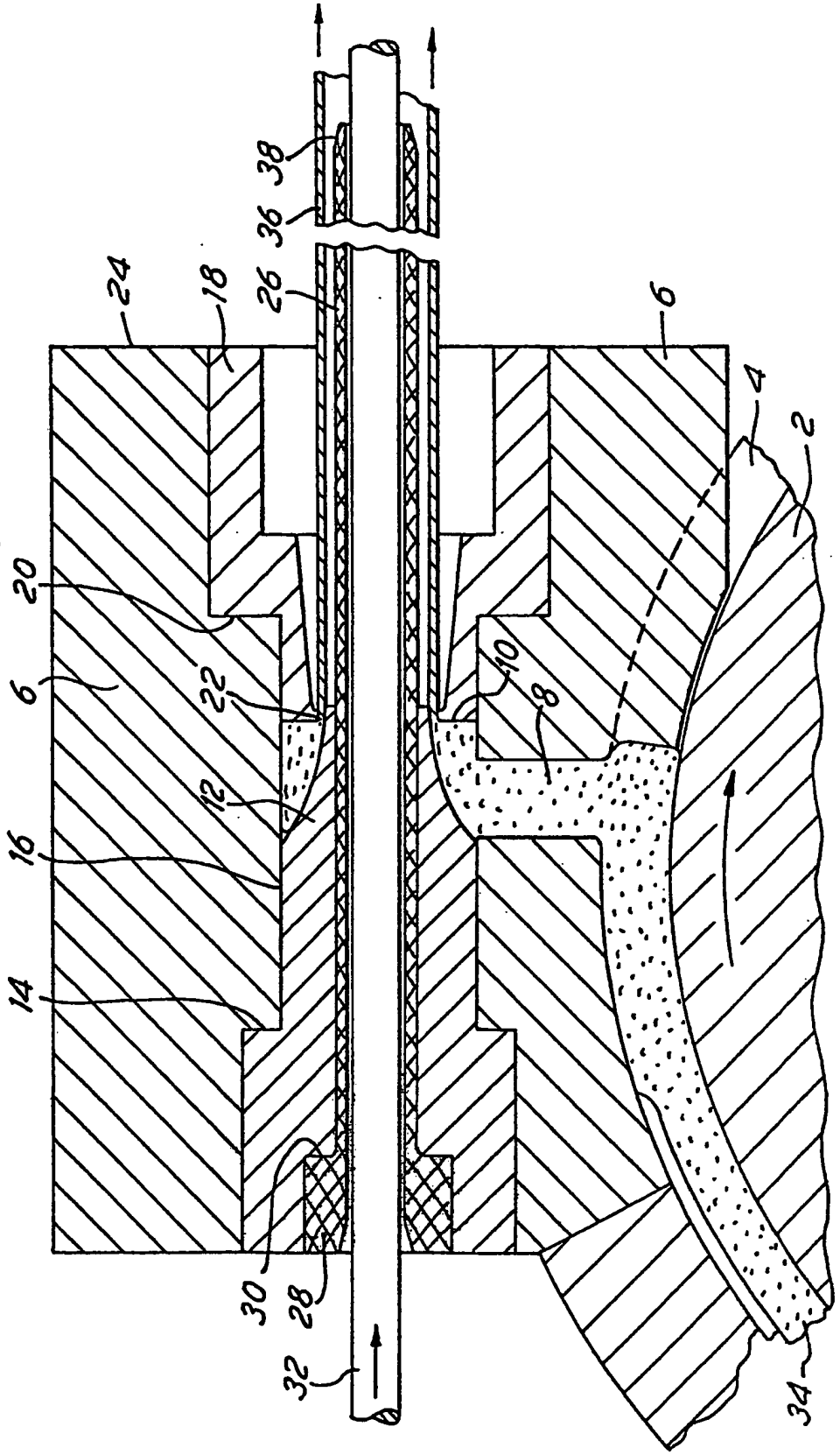
2. Continuous extrusion apparatus as claimed in Claim 1, characterised in that the shroud (26) is of a flexible form.

3. Continuous extrusion apparatus as claimed in Claim 1 and Claim 2, characterised in that the shroud (26) is formed of glass fibres.

4. Continuous extrusion apparatus as claimed in Claim 3, characterised in that the glass fibres are woven to form a flexible, braided, sleeve.

5. Continuous extrusion apparatus as claimed in any preceding Claim, characterised in that the shroud (26) is formed with an enlarged end portion (28) arranged to seat upon a shoulder (30) formed in the mandrel (12).

6. Continuous extrusion apparatus as claimed in Claim 5, characterised in that the shroud (26) is a sliding fit within the mandrel (12).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